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Title: Sensitivity Analysis and Uncertainty Quantification of the Feynman Y and Sm2

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Sensitivity Analysis and Uncertainty Quantification of the Feynman Y and Sm_2

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X-Computational Physics

Monte Carlo Methods, Codes, and Applications

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Bayo Canyon Trail Hike

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- Educational Background
  - BS, Nuclear Engineering, ISU, 2014
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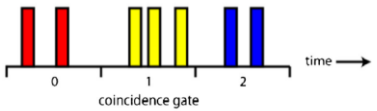
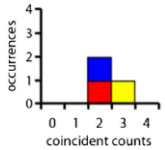
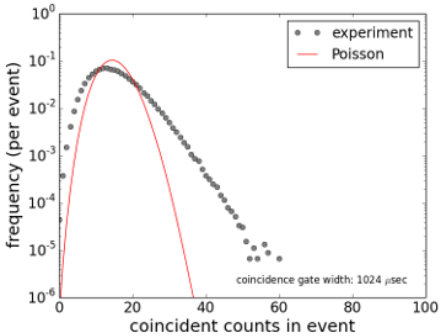
- X-Computational Physics
  - Monte Carlo Methods, Codes, and Applications
  - Jeffrey A. Favorite

- Research
  - Sensitivity analysis and uncertainty quantification of the Feynman Y and Sm_2
  - Data assimilation of nuclear cross sections applied to neutron multiplicity counting experiments

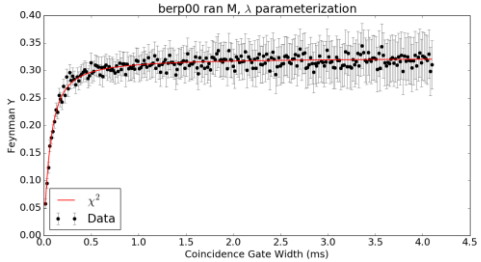
Research Overview and Motivation

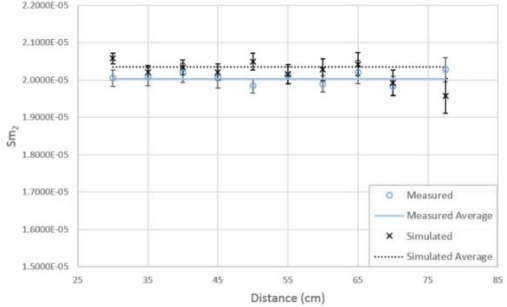






- Neutron multiplicity counting (NMC) is a method of NDA of SNM
- Fission chain-reactions are a non-Poisson distributed process
- Feynman Y used to infer integral properties of SNM e.g. neutron lifetime/multiplication
- Sm_2 is independent of the detector response function
- Reliable characterization of SNM requires SA/UQ of Y and Sm_2



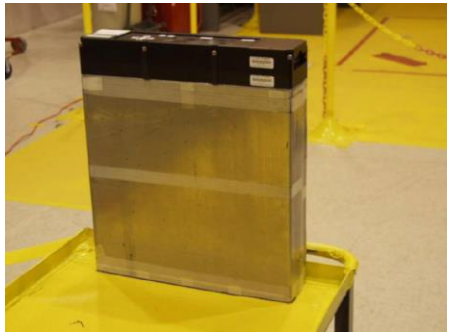


Research Approach

- **PARTISN simulations of neutron multiplicity counting of a 4.5 kg sphere of weapons grade plutonium metal (BeRP ball)**
  - Counted with the nPod neutron multiplicity counter
  - Simulated with:
    - No reflector
    - 3.8 cm of polyethylene
- **First-order, adjoint-based perturbation theory SA approach by Sean O’Brien**

BeRP ball nested in polyethylene reflectors

nPod neutron multiplicity counter



Summary of Results

- Sm_2 has less uncertainty due to nuclear cross sections than Y
- NDA of SNM using Y may be preferred if the detector response function is known *a priori*
- Invariance of Sm_2 to detector response function makes its relationship to reflector thickness or neutron multiplication useful